APPLICATION

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FOR

SOFTWARE ENGINE FOR MULTIPLE, PARALLEL PROCESSING
WITH NEURAL NETWORKS

BY

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SOFTWARE ENGINE FOR MULTIPLE, PARALLEL PROCESSING WITH NEURAL NETWORKS

This application claims the benefit of U.S. Provisional Application No. 60/462,323, filed April 14, 2003.

BACKGROUND OF THE INVENTION

Many fields dealing with research or other endeavors require the use and manipulation of huge data arrays. All fields that need to solve and predict problems and solutions need methods of handling large data arrays. Current methods of dealing with large data arrays are inadequate to properly consider and integrate data from the real world.

Past and present machines are deficient because the software for these processes is sequential. Sequential processes are not able to handle the huge data arrays of randomness found in the real world. Additionally, current machines are not able to communicate with one another in order to upgrade information.

Current machines are also not able to solve problems or predict problems and solutions in tiered structures.

Needs exist for improved methods for integrating data into large data arrays and predicting and solving problems using these data arrays.

SUMMARY OF THE INVENTION

The present invention is a method for handling large data arrays that incorporates data from the past and present in many fields and integrates this data for a solution. The present invention can handle most software. It is possible to incorporate the ubiquitous randomness in the real world and integrate data from the laboratory and academic worlds. Formulae for

accomplishing this integration are located in the chips as integral parts. The chips communicate with each other in a neural network.

The present software engine is unique in that it is designed to deal with real world events in any time interval, and predict events in succeeding time intervals. Another unique feature is that the software and hardware elements are designed as integral entities. This is different from all other computer systems where software and hardware are designed as separate entities, generally by separate companies.

The Brownian motion equation is used to deal with real world, random events and to predict succeeding events. This equation is divided into two vectors. Each vector is a sum of a series of matrices that approaches infinity to avoid the problem of coping with random events by using deterministic functions and methods. Elements of each matrix are a Bayes' equation.

A vector is equal to the sum of all the matrices that represent the various components of the entity. One of the two vectors can be designated by the user to represent the vector on which external forces are acting. The other vector represents forces acting on the entity internally.

The hardware of the present invention must be structured with the Brownian motion equation, Bayes' equation and its matrices as integral components. All data are input to a common bus bar. All data are then sent to all nodes simultaneously. Each node will have coded gates to admit the proper data to the appropriate matrix and Bayes' equation. Then, as the data are processed, they will be sent to a central data processing unit that integrates the data in the Brownian motion equation. The output is displayed in linguistic terms or in digital form by means of fuzzy logic.

These and further and other objects and features of the invention are apparent in the disclosure, which includes the above and ongoing written specification, with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of the software engine from inputs to outputs.

Figure 2 is a top view schematic diagram of the software engine.

Figure 3 is an example of vector inputs for internal and external parameters.

Figure 4 is an exploded view of a matrix system.

Figure 5 is a diagram of a matrix system superimposed on a human to show how the

vector information is applied to a diagnosis situation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present software engine is unique in that it is designed to deal with real world events

in any time interval, and predict events in succeeding time intervals. Another unique feature is

that the software and hardware elements are designed as integral entities. This is different than

all other computer systems where, generally, separate companies design software and hardware

as separate entities.

The hardware of the present invention is structured with the Brownian motion equation,

Bayes' equation and its matrices as integral components. All data are input to a common bus bar.

All data are then sent to all nodes simultaneously. Each node will have coded gates to admit the

proper data to the appropriate matrix and Bayes' equation. Then, as the data are processed, they

will be sent to a central data processing unit that integrates the data in the Brownian motion

equation. The output is displayed in linguistic terms or in digital form by means of fuzzy logic.

Although randomness is ubiquitous in the real world, there are events and entities that are

constant. The diagonal of each matrix can be designated to manage these events and entities. A

user can code the other positions in a matrix so that these positions can be used for events and entities that occur randomly.

All elements and entities are linked by software. This software must be able to handle all dataflow in parallel paths simultaneously. Matrices must communicate with each other in massively parallel manner. This communication requires a neural architecture. Since each element is a Bayes' equation, processing requires parallel, simultaneous communication of the elements with data stored from population data and/or data stored from past events.

Past and present software are almost exclusively sequential software. Multiple, parallel processing software in a neural network is a departure from these sequential entities. Therefore, software for this engine is written anew, or the best of sequential software is grafted/spliced together in multiple, parallel processing neural networks to accomplish this task.

The present invention allows users with their own software to utilize the software engine. There are commercially available systems that convert data in one software system to another. Fuzzy logic also allows the conversion of linguistic data to digital data and vice versa.

Another unique feature of this software engine is the integration of multiple, parallel processing in a neural network with Veitch-Karnaugh mapping. In the real world, there are numerous circumstances where events and entities are linked at varying levels. The Brownian motion equation permits prediction of changes at varying levels as well as changes in different areas within the same level. Bayes' equation permits evaluation and prediction based on past and present data. Fuzzy logic will make manipulation of linguistic and digital data possible.

Figure 1 illustrates the general structure of the present software engine 1. Figure 2 shows the input part 2. Multiple inputs 3 can be fed 5 to a software converter 7 if software language is different from the specific language designed for the software engine 1. Inputs 3 in the user's

language will pass through the software converter 7 without manipulation except for converting

from any user's language to the language or languages chosen for the software engine 1.

A bus bar 11 is circular, around which hundreds or thousands of chips 15 are arranged.

All inputs 9 go to every chip simultaneously. Each chip 15 handles about four gigabits or more

of information. The heavy lines in Figure 1 indicate the paths 17 to these primary chips 21. The

primary chips 21 are designated $A_{1,2,...}$, $B_{1,2,...}$, $C_{1,2,...}$, $D_{1,2,...}$ ad infinitum. Pairing of uppercase

letters indicates different levels on the circular bus bar 11. At level A, B, for example, hundreds

or thousands of chips 15 can exist. However, each chip 15 is distinct and indicated by subscript

numbers A_1, A_2, A_3, A_i, + ..., and B_1, B_2, B_3, B_i, + ... These chips 15 are unique because they

are the data bank of the system. The chips 15 are the foundation of a system that can cope with

large randomness, expressed as:

$$P(m, n, s+1) = 1/4 \ [P(m+1, n, s) + P(m-1, n, s) + P(m, n+1, s) + P(m, n-1, s)] \qquad (1)$$

The primary chips 21 incorporate the equation 31 as though it were in virtual reality. The

Brownian motion equation is split into two vectors. These vectors are m and n, as shown in

Table 1 and Figure 3. The m vector 33 embodies all factors that are internal 34 to the entity,

event or situation. The n vector 35 embodies all factors that are external 36 to and have an effect

on an entity, event or situation. The size of the n 35 and m 33 vectors varies according to the

size and complexity of the existing problem. The size of the vectors corresponds to the size

necessary to solve the problem and predict outcomes related to a specific entity or entities. The

entities are open-ended to cope with unanticipated or random factors that affect the entity or

entities.

Each vector is a series 41 of matrices 43 and each matrix 43 has elements 45 that are

Bayes' equations. In the primary chip, the denominator of a Bayes' equation is a summation of

data from a population of entities in a similar class or group, and primary chips are connected to each other by a secondary bus bar so that the denominator of a Bayes' equation can be continuously updated. Graphically, these m 33 and n 35 vectors are represented in Table 1 as follows:

Table 1

$$
m = \textit{Internal Factors} = \begin{bmatrix} Z_{11} \ldots\ldots Z_{1w} \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ Z_{v1} \ldots\ldots Z_{vw} \end{bmatrix} + \begin{bmatrix} Y_{11} \ldots\ldots Y_{1w} \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ Y_{v1} \ldots\ldots Y_{vw} \end{bmatrix} + \ldots
$$

$$
n = \textit{External Factors} = \begin{bmatrix} U_{11} \ldots\ldots U_{1w} \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ U_{v1} \ldots\ldots U_{vw} \end{bmatrix} + \begin{bmatrix} S_{11} \ldots\ldots S_{1w} \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ \ldots\ldots\ldots \\ S_{v1} \ldots\ldots S_{vw} \end{bmatrix} + \ldots
$$

Each element of a matrix is a Bayes' equation that is represented in the form:

$$
P(c_i \mid E) = \frac{P(c_i)P(E \mid c_i)}{\sum_{j=1}^{s} P(c_j)P(E \mid c_j)}
\tag{2}
$$

As an example, the denominator, $\sum_{j=1}^{s} P(c_j)P(E \mid c_j)$, is a data storage bank or similar to long-term memory in a human hippocampus of the brain. The numerator, $P(c_i)P(E \mid c_i)$, is recent events or the equivalent of short-term memory in the human prefrontal cortex of the brain. This makes Bayes' equation a key to the Turing Machine.

The entities m, n, and Bayes' equation are located in the primary chips 21, A, B, C, …. Vector m 33, internal factors 34, is located in primary chips 21 A, C, E, …. Vector n 35, external factors 36, is located in primary chips 21 B, D, F, …. Vectors m and n are a series 41 of

matrices 43. Each matrix can be designated by the user to include factors integral with the entity and those factors that influence the entity from external sources. Data in the primary chips 21 are obtained from historical sources, data banks and population studies treated by meta analysis.

As multiple inputs 9 stream into the primary chips 21, they are matched with data already present in the chips. If they match these data, then they are manipulated in the same manner as the stored data. The stored data is located in the diagonals of each matrix. Inputs 9 that are not matched are placed in other elements of the matrix.

Once data inputs are manipulated in the primary chips 21, data are sent to secondary chips 47. The secondary chips 47 are each associated with a primary chip, such as $A_{1,2,...}$ and $B_{1,2,...}$, and are associated with p_1, p_2, p_3, p_i, + ... Other primary chips, such as $C_{1,2,...}$ and $D_{1,2,...}$, are associated with t_1, t_2, t_3, t_i, + ..., and $E_{1,2,...}$ and $F_{1,2,...}$ are associated with h_1, h_2, h_3, h_i, + ... In the secondary chips 47, data are placed in the appropriate matrices and Bayes' equations. The secondary chips are connected to the secondary bus bar so that the denominator of a Bayes' equation for a specific entity can be updated continuously. A secondary chip 47 has multiple loci and each loci is coded for a specific entity. After data is placed in the appropriate matrices and Bayes' equations, the stream of matrices and Bayes' equations are sent to the central processing unit 49 where they are manipulated in the Brownian motion equation. The result of this manipulation is P(m, n, s+1) displayed 51 in linguistic or digital form or a combination of these forms. The central processing unit 49 uses the Brownian motion equation and internal and external vectors that are divided into series of matrices with elements of Bayes' equation for a specific entity.

There is a secondary bus bar 53, shown in Figures 1 and 2, that connects the primary chips 21 at all levels. All primary chips 21, that deal with information from data banks and

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population studies with meta analysis or recently acquired data, have automatic updating of each

Bayes' equation as determined by the coding of information bits. Loop circuits and learning

algorithms make this possible.

Diagnosis of human conditions, disease or dysfunctions is an example that illustrates the

architecture and operations of the present software engine. In particular, the diagnosis of

hypertension shows the operation of the system. When a patient is first seen in an office, clinic

or hospital, his or her vital signs or demographics are coded into the software to define the

patient as a specific entity or object. Blood pressure, pulse, heart rate, physical examination

findings and laboratory findings, as well as negative findings are entered into the packet of

information defining the patient.

During the data generation, each bit is designated according to whether it belongs to the

vector m, internal factors, or the vector n, external factors. Internal factors can include such

factors as type A personality, genetics/ethnicity, diseases, such as diabetes, nephritis,

hypercholesterolemia/hyperlipidemia, etc. External factors can include such factors as job stress,

divorce, errant children, socio-economic problems, difficulties with police, alcohol or drug

additions, etc.

Figure 3 shows inputting of data into the m 33 and n 35 vectors. In the primary chips 21,

for vector m 33, internal factors 34 are A, C, E, ..., and in the primary chips 21 for vector n 35,

external factors 36 are B, D, F, ... The first data packet is processed, each component 43, 45 of

each element of a matrix is a Bayes' equation 31 and it is compared to population studies defined

by meta analysis. Once these calculations are done, the packet is sent to a chip or locus, p_1, p_1,

..., p_n, in a large array that is specific for that patient. P_1, p_1, ..., p_n receive data packets from

primary chips A and B. Then the data packet is sent to the central processing unit where data are manipulated by the Brownian motion equation:

$$P(m, n, s+1) = 1/4 \ [P(m+1, n, s) + P(m-1, n, s) + P(m, n+1, s) + P(m, n-1, s)] \qquad (3)$$

Where $P(m, n, s+1)$ = probability of hypertension

This probability is treated by fuzzy logic so that it can be presented as an output in linguistic terms or digital form or a combination of both.

Figure 4 shows the hypertension example illustrating the software engine linkage to Veitch-Karnaugh mapping 55. Squares are either 0 or 1. In the illustration, the squares that do not have a one, 57, contain a value of zero, 59. The equation that expresses this particular configuration is:

$$f = \bar{x}_1 \bar{x}_3 \bar{x}_5 V x_1 x_3 x_5 V \bar{x}_3 x_4 \bar{x}_5 x_6 \qquad (4)$$

Figure 5 shows the Veitch-Karnaugh 55 mapping overlaid on a human 61 to show the application of the matrix values to a real world system.

Each patient's data packet can be sent to the Veitch-Karnaugh mapping system 55 as well as the output screen 51. Here, the Brownian motion equation is used in a slightly different form from that used to diagnose hypertension. However, the patient's data packet is still utilized. Other factors, such as cardiac ejection, arterial and venous vectors, pulmonary circulation vectors, pulse pressure, etc. are also included to determine cardiovascular vectors in the system as compartmentalized by Veitch-Karnaugh mapping. The probability, $P(m, n, s+1)$, being one in any square can be determined by fuzzy logic since the probability can be measured from 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0. Squares with zero can be treated similarly. Output from the Veitch-Karnaugh mapping 55 can be displayed on a Computer Assisted Design (CAD) monitor. A windows-type of display can be part of this screen that displays patient parameters.

Shortening or lengthening the bus bar 11, as shown in Figure 1, creates modifications of the architecture. The bus bar 11 can be modularized to fit the purpose of the user and applications. The secondary bus bar 53 can also be modularized.

To build architecture for a massively parallel supercomputer, the bus bar 11 can be enlarged with a central core of liquid nitrogen. The material for the bus bar 11 will be made of a high temperature superconductor. The bus bar 11, primary 21 and secondary 47 chips, as well as central processing units 49 will be surrounded by liquid nitrogen cooling coils. The secondary bus bar 53 will also be made of high temperature super conducting materials. Massive cooling permits the use of Josephson junctions and circuits. As in the smaller computer, the bus bars can be modularized so that their lengths can be increased. In addition, many bus bars can be linked in parallel and in a neural network for a massive architecture.

The example of using this system in hypertension diagnosis, treatment and outcome is only one of many applications in many diverse fields. The following is a partial list of applications:

1. Medicine

2. Biomedical technology

3. Chemistry

4. Drug design

5. Toxicology

6. Business management

7. Earthquake prediction

8. Biotechnology

9. Personnel selection, training and upgrading

10. Air traffic control and management

11. Global decision making

12. Domestic decision making

13. Crime prevention and detection

14. Food and water supply and demand

15. Weather prediction

16. Oil exploration

17. Environmental pollution

18. Plasma physics

19. Stock market prediction

20. Computer security

21. Aerodynamics

While the invention has been described with reference to specific embodiments, modifications and variations of the invention may be constructed without departing from the scope of the invention.